Charge and spin order in layered Co and Mn perovskite oxides at half-doping

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Abstract

A checkerboard charge order (CO) occurs in many perovskite manganese and cobalt oxides at half-doping. Because it is accompanied by a cooperative displacement of the oxygen ions, CO has a clear neutron scattering signature. It was found that CO in the layered oxides, $La_{0.5}Sr_{1.5}CoO_4$ and $La_{1.5}Sr_{0.5}MnO_4$ is short-range, while that in their pseudocubic relatives is a long-range-ordered superstructure. A simple generic model which maps the charge-ordering interactions on the random field Ising model appears to provide a good basis for understanding this interesting observation. Spin order which usually follows CO at lower T is often incommensurate. This finding is also puzzling, because on the mean field level the incommensurability on a square lattice requires at least a third-neighbor coupling. An observation that spin-spiral state better adapts to the lattice distortion provides possible explanation to this experimental finding.